

We claim:

1. A communication method for multilevel coded optical signal transmission comprising the step of:
 - driving at least two modulators with at least two synchronous data signals
 - 5 having the same data rate to generate an optical signal using differential phase shift keying and amplitude shift keying modulation.
2. The method of claim 1 further comprising receiving the optical signal using a receiver including a balanced detector for detection of the differential phase shift keyed portion of the optical signal.
- 10 3. The method of claim 1 further comprising providing post nonlinear-phase-shift compensation to substantially reduce the penalty from self-phase-modulation during nonlinear transmission.
4. The method of claim 1 wherein the amplitude shift keying modulation generates chirp-free optical signals.
- 15 5. The method of claim 1 wherein the amplitude shift keying modulation generates chirped optical signals.
6. The method of claim 1 wherein the amplitude shift keying modulation has an extinction ratio of between about 5 dB and about 10 dB.
7. The method of claim 1 further comprising providing pulse generation to allow
20 for generation of RZ optical signals.
8. A transmitter apparatus for generating differential phase amplitude shift keyed optical signals comprising:

a modulator means, including at least two modulators driven by synchronous data signals having the same data rate, adapted to generate an optical signal using differential phase shift keying and amplitude shift keying modulation.

9. The apparatus of claim 8 wherein the at least two modulators are modulators
5 selected from the group consisting of a Mach-Zehnder modulator, a single-waveguide modulator, or an electro-absorption modulator.

10. The apparatus of claim 8 wherein the modulator means is adapted to provide chirp-free amplitude shift keying modulation.

11. The apparatus of claim 8 wherein the modulator means is adapted to provide
10 chirped amplitude shift keying modulation.

12. The apparatus of claim 8 wherein the extinction ratio of amplitude shift keying modulation is between about 5 dB and about 10 dB.

13. The apparatus of claim 8 further comprising a differential encoder means coupled to the modulator means.

14. The apparatus of claim 8 further comprising a pulse generator operatively
15 coupled to the modulator means to allow for generation of RZ optical signals.

15. An optical transmission system comprising:
a first modulator adapted to receive a first data signal;
a second modulator coupled to the first modulator and adapted to receive a
20 second data signal;
wherein the first and second data signals are synchronous and have the same data rate, and wherein the first and second modulators are adapted to generate a

multilevel coded optical signal using differential phase shift keying and amplitude shift keying modulation.

16. The system of claim 15 further comprising a receiver including a balanced detector for detection of a differential phase shift keyed portion of the optical signal.

5 17. The system of claim 16 wherein the receiver further comprises a post nonlinear-phase-shift compensator for substantially reducing the penalty from self-phase-modulation during nonlinear transmission.

18. An optical transmission system comprising:

an optical 4-ary DP-ASK transmitter including at least two modulators adapted
10 to provide an optical 4-ary DP-ASK modulated signal; and

an optical receiver including:

a DPSK receiver including a delay interferometer and a balanced
receiver to detect a DPSK modulated portion of the 4-ary DP-ASK
modulated signal; and

15 an optical intensity receiver to detect an ASK modulated portion of the
4-ary DP-ASK modulated signal.